

# LINGULIDA (BRACHIOPODA) FROM THE EARLY PERMIAN OF ARGENTINA

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A small fauna of inarticulate brachiopods from the lower beds of the Santa Elena Formation of the Calingasta-Uspallata Basin, Mendoza Province, Argentina is documented. The new genus *Argentiella*, type species *Argentiella stappenbecki* sp. nov., is described. *Orbiculoidea* sp. is also documented from the same fauna. The fauna occurs in beds which indicate an initial transgressive event overlying fresh water, plant bearing strata.

*Keywords:* Lingulida, Brachiopoda, Early Permian, Argentina

REPRESENTATIVES of the Lingulida (usually referred to as inarticulate brachiopods) have been widely recorded from the Late Palaeozoic of Argentina as summarised in the two volumes edited by Archangelsky (1987, 1996). Most of the records of inarticulate brachiopods are from localities and stratigraphical formations that are now regarded as being of Early Permian (Asselian–Sakmarian) age. Previous records have referred these brachiopods to the genera *Orbiculoidea* and *Lingula*. We note that several species of *Orbiculoidea* have been described and illustrated from the Early Permian of Argentina by authors such as Reed (1927), Fossa Mancini (1933), Feruglio (1934), Antelo (1972), and Lech (1990). However, so-called *Lingula* reports from Argentina have never been accompanied by illustrations. Study of new specimens has revealed that they are not true *Lingula*. While being allied to genera such as the Permian *Semilingula* (Popov 1990, in Egorov & Popov 1990), Carboniferous to Cretaceous *Lingularia* (Biernat & Emig 1993), Devonian to Carboniferous *Barroisella* (Hall & Clarke 1892) and the Brazilian Permian *Langella* (Mendes 1961), the Argentinian specimens demonstrate different dorsal internal visceral and muscular structures and hence appear to belong to a new genus.

In this paper we describe and figure the lingulid as *Argentiella* gen. nov., with the type species *Argentiella stappenbecki* sp. nov. We also figure a

poorly known species of *Orbiculoidea*. Both come from the Permian strata of the Santa Elena Formation (Yrigoyen 1967) in the Calingasta-Uspallata Basin, Mendoza Province, Argentina.

*Repository.* The fossils described in this paper are registered with the prefix IPI (*Instituto de Paleontología, sección Invertebrados*), housed in the collections of the Miguel Lillo Foundation (San Miguel de Tucumán, Argentina).

## STRATIGRAPHICAL, BIOSTRATIGRAPHICAL AND PALAEOECOLOGICAL IMPLICATIONS

Santa Elena Formation (Yrigoyen 1967) outcrops are located in the south-western extreme of the Argentine Precordillera, on the west flank of the Uspallata Hill, about 9 km east of Uspallata village in Mendoza province. (Fig 1A-D).

Material described herein has been collected from outcrops of the Santa Elena Formation south of the Uspallata Creek (Fig. 2), which would correspond to the “Tramojo Serie” defined by Keidel (1939). This stratigraphical section was considered Late Carboniferous by different authors (Dessanti & Rossi 1950; Rodriguez 1966). Rodriguez (1966), mentioned the presence of *Neospirifer leoneitensis* (Harrington 1938), *Dielasma* cf. *itaitubense* Derby

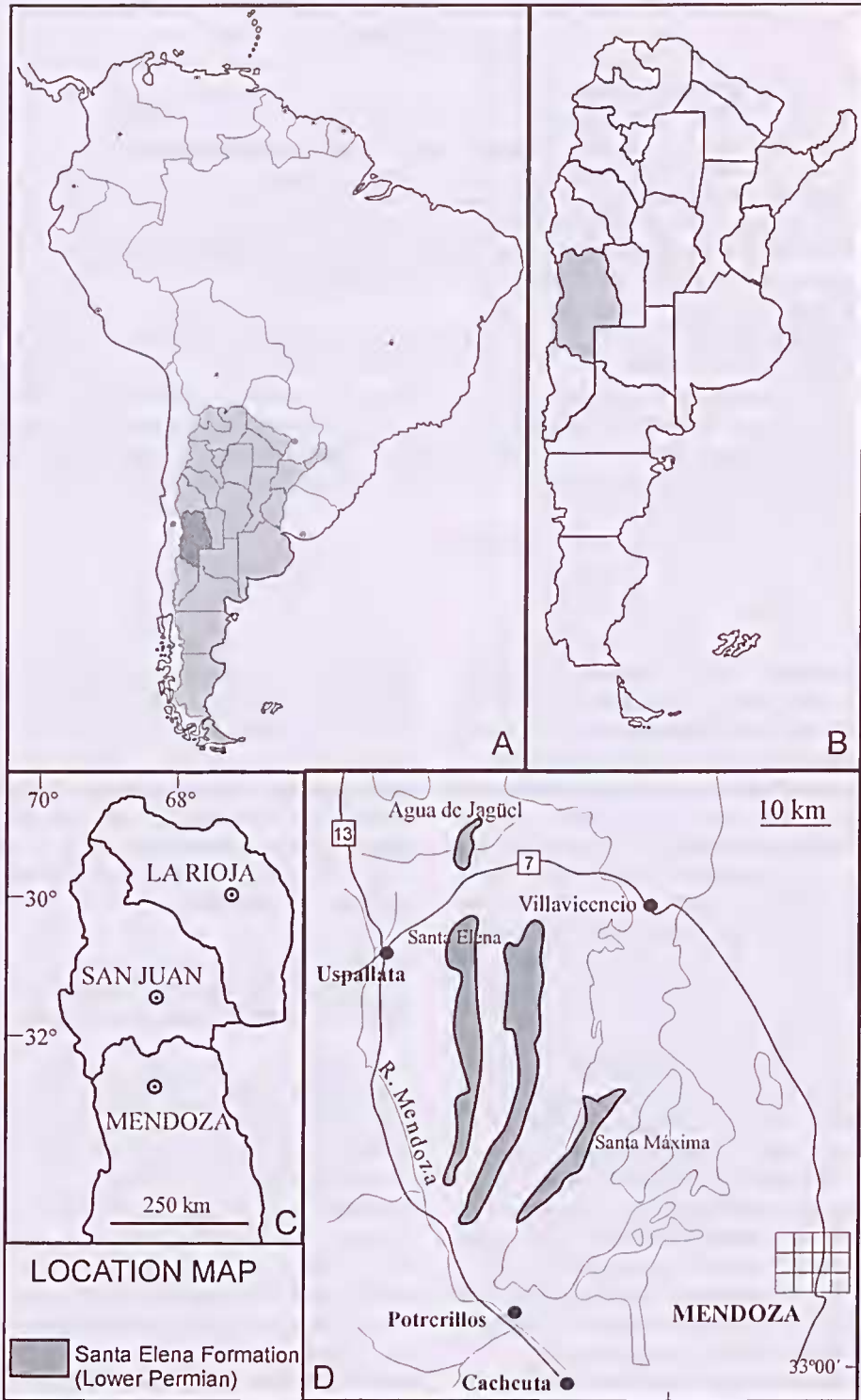


Fig. 1 A-D. Location of the study area.

1874, *Septosyringothyris keideli* (Harrington 1938), *Orbiculoidea* sp., *Pleurotomaria* sp. ind., *Conularia* sp., *Carbonicola promissa* (Frenguelli 1945), *Carbonicola* cf. *timenda* Leanza 1948, *Anthraconya diluta* Leanza 1948, *Naiadites?* sp. and gastropods. Later, Arehangel'sky & Lech (1985), suggested a youngest early Permian age for this formation. These authors identified eight fossiliferous horizons along this section, in which they identified brachiopods (*Lingula* sp., *Orbiculoidea amae* Feruglio 1934, *Orbiculoidea* aff. *saltensis* Reed 1927, *Orbiculoidea* sp., *Crurithyris* aff. *roxoi* (de Oliveira 1936), *Cancrinella* aff. *farleyensis* (Etheridge & Dun 1909) *Septosyringothyris?* sp., *Chonetes?* sp.), bivalves (*Aviculopecten* sp., *Cypricardinia?* sp., *Myonia* sp., *Promytilus* sp.) and gastropods. However, none of these species were described or figured by Arehangel'sky & Lech (1985).

Outcrops of the Santa Elena Formation south of the Uspallata Creek (Fig. 2), are distinguished by a sedimentary sequence characterized by a repetitive alternation of sandstone and mudstone facies. Fossils appear in the lower, middle and upper parts of the section (Fig. 3).

The Santa Elena section is interpreted as a shelf sequence, represented by stacking of successive upward coarsening parasequences that range from offshore-transitional (lingulid horizon) to a shoreface (S0 to S1 horizons). From the middle to the upper part of the section (S2 and S3 horizons), hummocky and swaley storm deposits, alternating with heterolithic facies, are recognised.

The brachiopod assemblage described herein appears in the lower part of this unit and is composed of inarticulate brachiopods (*Argentinella stappenbecki* sp. nov. and rare *Orbiculoidea* sp. A). The lingulid *Argentinella* is the dominant element in this assemblage, hence we informally named it the "Lingulida horizon" (S0), (Fig. 3). The "Lingulida horizon" is at the base of a stratigraphical interval about 10 m thick and is composed of alternating sandstones and black mudstones with calcareous concretions. This interval includes four fossil assemblages composed of brachiopods, bivalves and gastropods (Fig. 3): S0a, contains the brachiopods Trigonotretinae ind. and *Orbiculoidea* ind.; S0b, contains the brachiopods *Septosyringothyris* sp. and Trigonotretinae ind. and the bivalve *Schizodus?* sp.; S1 contains bivalves and S1' contains the brachiopod Trigonotretinae ind. and the bivalve Parallelodontidae ind. This fossiliferous interval (S0-S1', Fig. 3), is located immediately above a bed with a floral assemblage, approximately equivalent

to the NBG (*Nothorhacopteris-Botrychiopsis-Ginkgophyllum*) Biozone (Arehangel'sky & Azeuy 1985).

In the middle part of the Santa Elena Formation a second fossiliferous assemblage has been identified (S2, Fig. 3). It is composed of brachiopods (*Costatumulus amosi* Taboada 1998, *Orbiculoidea* sp. B, *Crurithyris* sp. and *Septosyringothyris* sp.), bivalves and gastropods. Biostratigraphically, this fauna has been recently included in the *Costatumulus amosi* Biozone, considered to be Early Permian (Asselian), by Taboada (1998).

The "Lingulida horizon" represents an initial flooding event at the base of this sequence, the onset of marine conditions; it has been interpreted as a shallow marine environment by some authors (Arehangel'sky & Arehangel'sky 1987).

Brachiopods from the "Lingulida horizon" occur in "nests" or "patches" about 1 cm thick, concordant with the bedding. The valves occur in horizontal positions, with good shell preservation and a low proportion of fragmentary valves. A range of ontogenetic stages are preserved. Many of the valves are disarticulated. These characteristics suggest that the brachiopods from the "Lingulida horizon" can be considered a para-autochthonous assemblage. We assume that the lingulid occurrence indicates shallow water, transgressive conditions, with variations in salinity. Emig (1997) stressed the fragile nature of lingulid shells and their poor preservation in normal marine environments. As noted by Kowalewski (1996), lingulids in the Palaeozoic are often complete and well preserved and are common in assemblages with some reworking. Emig (1986) suggested that assemblages of flat-lying disarticulated valves may be produced by lower salinity, coarser grained sedimentation and storm events. Buatois et al. (2001) identified unusual communities characteristic of hyposaline environments in the Santa Elena Formation. Brackish ecosystems have also been identified from elsewhere in the Late Palaeozoic of Western Argentina and may suggest dilution of normal salinity related to melting of ice in southern Brazil.

## SYSTEMATIC PALAEONTOLOGY

Subphylum LINGULIFORMEA Williams et al. 1996

Family LINGULIDAE Menke 1828

Subfamily LINGULINAE Menke 1828

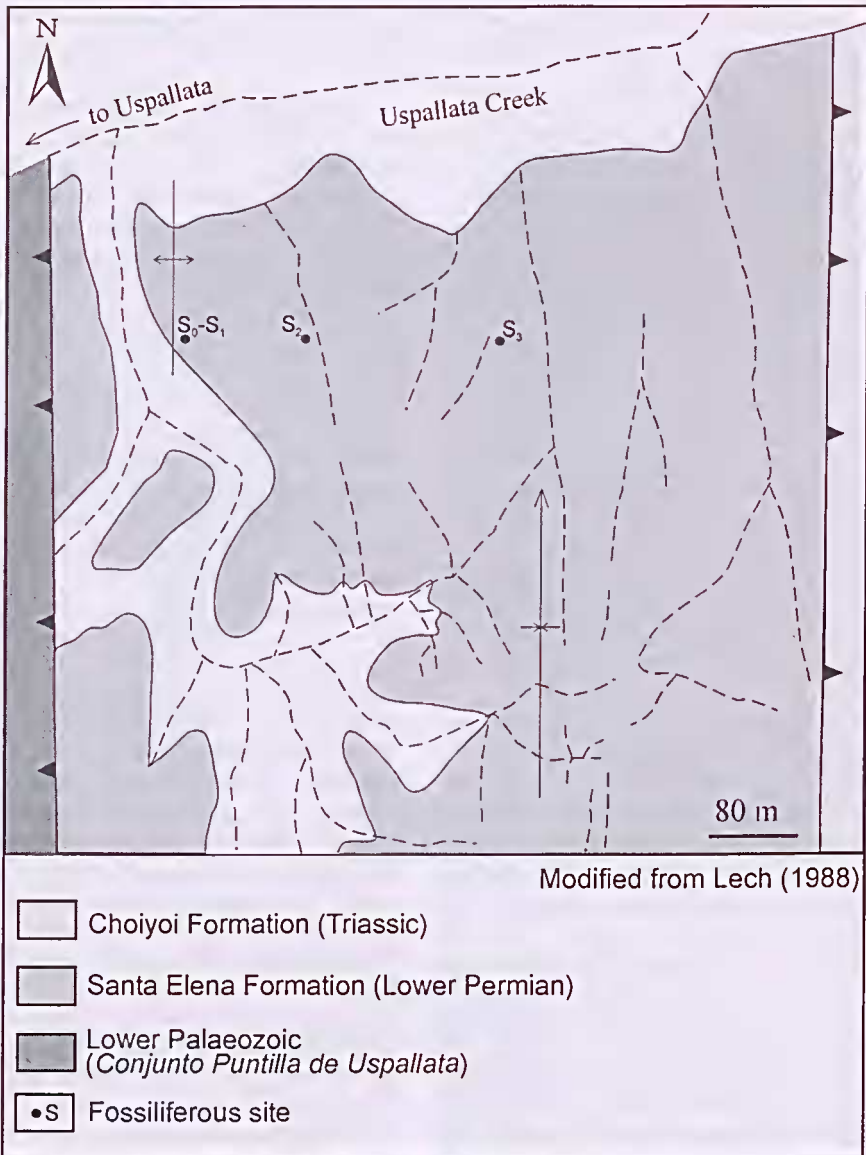


Fig. 2. Distribution of the Santa Elena Formation and the fossiliferous localities.

Genus *Argentiella* gen. nov.

*Type species. Argentiella stappenbecki* sp. nov.

*Diagnosis.* Feebly developed dorsal median ridge and ventral visceral area; both extend anteriorly about two-thirds of shell length. Anterior dorsal interrelated ridge absent. Ventral sub parallel-sided broad median ridge not developed in posterior fifth of shell.

*Discussion.* The new genus shares numerous features with other representatives of the Lingulidae Menke (1828) as defined by Holmer & Popov (2000). Emig (2003) has proposed further restrictions on the use of the family name, with which we agree. He has restricted the name to include only three genera (*Lingularia* Biernat & Emig 1993, *Lingula* Bruguiere 1797 and *Glottidia* Dall 1870), with other genera only provisionally placed in the family. We also note that the use of the generic *Lingula* is too broadly applied to

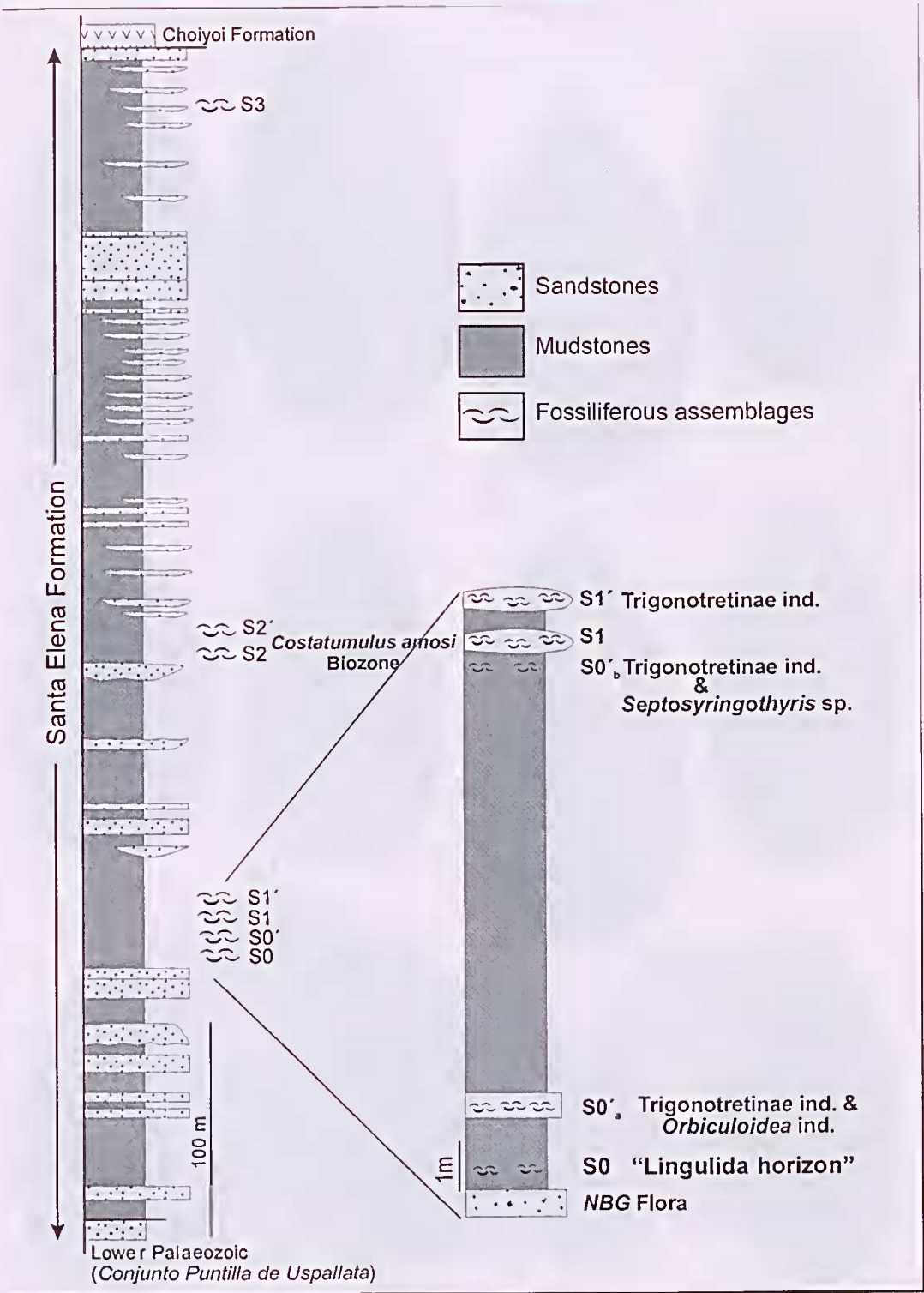


Fig. 3. Vertical distribution of fossiliferous assemblages in the studied section and detail of the lingulid horizon.

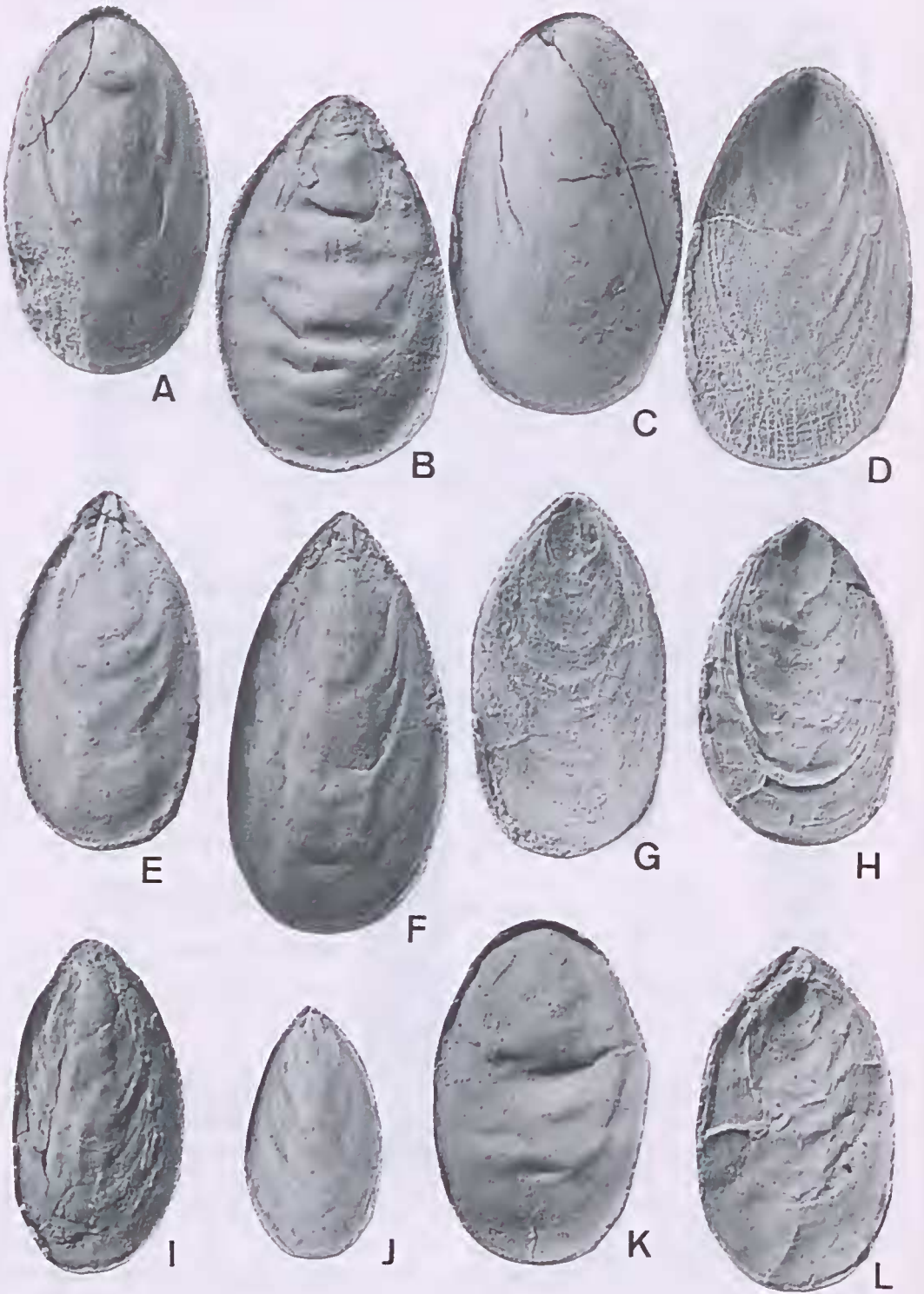


Fig. 4 A-L, *Argentiella stappenbecki* sp. nov. A, IPI 3625, internal mould of dorsal valve, x6.5. B, IPI 3626, internal mould of ventral valve, x6. C,D, Holotype, IPI 3627a-b, internal and external moulds of dorsal valve, x7. E, IPI 3628a, internal mould of ventral valve, x6. F, IPI 3629, internal mould of ventral valve, x6.5. G, IPI 3628b, external mould of ventral valve, x6.5. H, IPI 3630, external mould of ventral valve, x5.5. I, IPI 3631, internal mould of ventral valve, x6.5. J, IPI 3632, internal mould of ventral valve, x6. K, IPI 3633, internal mould of dorsal valve, x6. L, IPI 3634, external mould of ventral valve, x6.

any generally linguliform fossil shell, as for example by Rodland & Botjter (2001).

The new genus is closest to the Late Devonian-Early Carboniferous genus *Barroisella* Hall & Clarke (1892), type species *Barroisella campbelli* Cooper (1942), but lacks the dorsal anterior intereolated ridge of that genus. The ventral median ridge of the new genus does not extend as far posteriorly as in *Barroisella*.

*Argentiella* is also close to *Langella* Mendes (1961), a genus from similar age strata from eastern South America. *Langella*, with type species *Lingula imbitivensis* de Oliveira (1930) is well understood through the works of Martins (1948), Pinto (1949), Lange (1952), Mendes (1961) and Rocha-Campos (1967) who have illustrated many specimens of the type species. From *Langella*, the new genus is chiefly differentiated by means of its differing details of the dorsal and ventral median ridges and its low ventral fold (fastigium).

The Carboniferous to Cretaceous *Lingularia* Biernat & Emig (1993), type species *Lingularia similis* Biernat & Emig (1993), possess a different shell outline and distinctive internal visceral impressions, unlike those of *Argentiella*.

*Semilingula* Popov (1990, in Egorov & Popov 1990), with type species *Lingula? miloradovichi*

Ifanova 1972, from the Permian of the Arctic and Australia, is also close morphologically to *Argentiella* but has a more parallel-sided shell and differing median internal ridge details to those of the new genus.

We consider that Ifanova (1972: 77-78) was correct in renaming *Lingula arctica* sp. nov. of Miloradovich (1936) as *Lingula? miloradovichi*, summarised by Arehbold (1981: 174-175). *Lingula arctica* was first proposed by Wittenberg (1910) for a Triassic species and hence Miloradovich's (1936) proposal in the same generic name for a new taxon is an example of a primary homonym (ICZN Article 57). There was no indication by either Popov (1990) or Holmer & Popov (2000) that Miloradovich's usage was chosen under the provisions of ICZN Article 69.2.4. Neither work referred to Wittenberg's (1910) first usage of the binomen *Lingula arctica* or to Miloradovich's (1936) subsequent invalid usage of the binomen.

***Argentiella stappenbecki* sp. nov.**

Figure 4A-L.

*Holotype*. IPI 3627a-b, a dorsal valve internal mould and external mould, figured as Figures 4A and 4B herein.

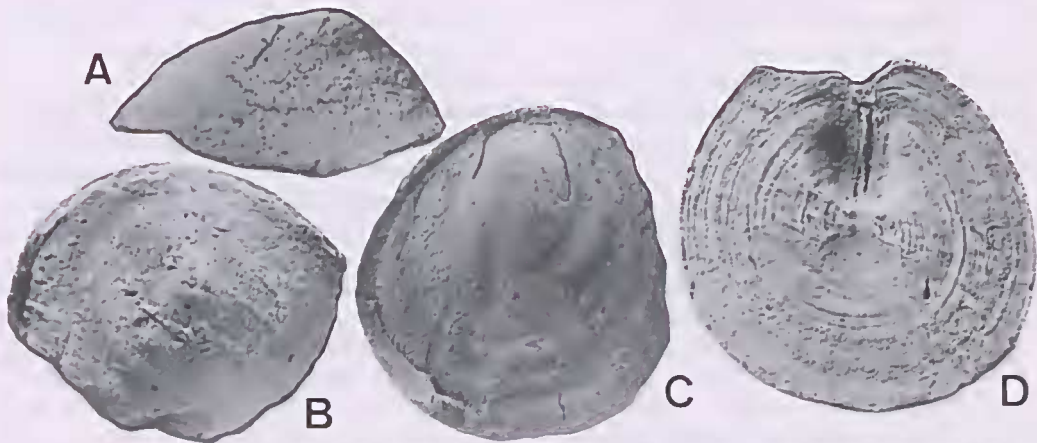


Fig. 5, A-D, *Orbiculoidea* sp. A,B, IPI 3635, internal mould of dorsal valve, x7.5. C, IPI 3636, internal mould of dorsal valve, x7. D, IPI 3637, external mould of ventral valve, x7.

*Size Ranges.* Maximum width – 1.9–5.8 mm; Maximum length – 3.1–9.4 mm.

*Etymology.* Named for Dr Richard Stappenbeck, pioneer Argentinian geologist.

*Diagnosis.* Shell elongate, oval; ventral umbo pointed; pedicle groove narrow. Propareas small distinct. Dorsal median ridge weakly impressed, extending anteriorly for two-thirds of valve length. Ventral visceral area extending about two-thirds valve length.

*Material.* Seven internal moulds of dorsal valves (IPI 3625, 3627a, 3633, 3638a, 3639, 3665, 3670); nine internal moulds of ventral valves (IPI 3626, 3628a, 3629, 3631, 3632, 3675, 3667a, 3669, 3671); five external moulds of dorsal valves (IPI 3627b, 3638b, 3666, 3668, 3672); four external moulds of ventral valves (IPI 3628b, 3630, 3634, 3667b).

*Description.* Shell elongate, oval in outline, biconvex. Maximum width at or anterior of mid-length. Shell exterior with fine growth lines and variably developed coarser growth stages, at times with appearance of ‘rugae’ (perhaps the result of slight compaction). Ventral valve with developed median fold (fastigium). Fold arises close to umbo and widens anteriorly at angle of 15° to 20°. Ventral umbo pointed and extended posteriorly. Pedicle groove narrow; propareas small, distinct. Ventral visceral area weakly impressed, vaguely flabellate. Twin, centrally located, ventral myophragms extend anteriorly up to two-thirds valve-length.

Dorsal valve evenly convex in cross-section. Dorsal median ridge weakly developed, extends anteriorly up to two thirds of valve length — weakly demarcated anteriorly from remainder of valve interior.

*Discussion.* Aspects of the morphology of *Argentiella stappenbecki* are close to those of the genera *Barroisella* and *Langella* and are discussed under the generic description.

Superfamily DISCINOIDEA Gray, 1840

Family DISCINIDAE Gray, 1840

Genus *Orbiculoidea* d’Orbigny, 1847

*Orbiculoidea* sp.

Figure 5 A-D

*Material.* Two internal moulds of dorsal valves (IPI 3635, 3636); one external mould of a ventral valve (IPI 3637).

*Comments.* Associated with the suite of *Argentiella* specimens are three specimens of a small species of *Orbiculoidea*: two dorsal valve internal moulds and one ventral valve internal mould. The dorsal valves are strongly convex, the ventral valve is essentially planar with a slightly convex apex. The pedicle track is narrow with a posterior foramen; the internal tube is narrow and opens in front of the posterior margin. The material, although limited, conforms well to the diagnosis of *Orbiculoidea* (type species *Orbicula forbesii* Davidson 1848) provided by Holmer & Popov (2000).

*Orbiculoidea* has been reported and illustrated from the Early Permian of Argentina by numerous authors (viz: Reed 1927: 132, pl. 13, fig. 1; Feruglio 1934 — based on illustrations provided by Fossa Mancini 1933: figs 1, 2; Antelo 1972: 162, pl. 1, fig. 5 and pl. 2, fig. 6; Amos 1979: 2 figs and Lech 1990: specimens referred to *Orbiculoidea* and *Oehlertella* including *Orbiculoidea asperotriangularis* Lech 1990, pl. 2, fig. 9 which is a *nomen nudum*). Available species names are *O. saltensis* Reed 1927 and *O. annae* Feruglio 1934, but these species require modern study based on large collections so that variability within the species can be defined.

*Orbiculoidea* is also abundant in the Early Permian of Brasil (de Oliveira 1930: 18, unnumbered plate and figure; Reed 1935: 201, 2 figs; Martins 1948: 237, figs 3, 4; Dutra et al. 1989: 73, 74, figs 8–12). Available names are *O. guarannensis* de Oliveira, 1930; *O. tayoensis* (Reed) 1935 and *O. maricaensis* Martins, 1948, but all species require modern study based on large collections.

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